

Literature

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Soil is the unconsolidated mineral or organic material on the immediate surface of the earth and serves as a natural medium for the growth of land plants. A fertile soil is one that contains adequate supply of all the nutrients required for the successful production of plant life. This is important because the full potential of crops is never realized if a shortage of nutrients occurs at anytime during the growth cycle.

Deficiency of the Nutrients in the Soil

Plants obtain nutrients from soil minerals, organic matter, fertilizer and from the atmosphere. Deficiencies of one or more nutrients may occur due to the reasons below :

1. The nutrient may be lacking in the soil or in the environment.
2. The nutrient may be too slowly available.
3. There may be an imbalance between nutrients.
4. The nutrients are lost due to the reactions of the positively and negatively charged ions.
5. Pesticides may cause loss of nutrients
6. Some components of the fertilizers may affect the health of the soil.
7. Microorganisms in the soil cause the loss of nutrients
8. Plantations without rotations of crops may cause some of the nutrients to be used up.
9. Erosion of the soil
10. Over cultivation of the soil.

Micronutrients

Nitrogen	Involved in growth, development and reproduction of a plant. An important component in structural, genetic and metabolic compounds in plant cell. Major component in photosynthesis. Energy transfer compound, which allows cells to conserve and use the energy released in metabolism.
Phosphorus	Role in capturing and converting the sun's energy to useful plant compounds essential for plant structure, seed yield and genetic transfer. Speeds up maturity of plant.
Potassium	Required for plant growth and reproduction. Vital in photosynthesis, translocation of photosynthates, protein synthesis, control of ionic balance, regulation of plant stomata and water use, and activation of plant enzymes. Increases root growth and improves drought tolerance. Builds cellulose and reduces lodging. Enhances many enzyme actions. Aids in food formation. Increases protein content in plant. Maintains turgor, helps retard crop diseases and nematodes

Boron	Involved in formation of cell walls, terminal buds and pollen tubes. Participates in regulation of starch production and translocation of sugars and starches. Improves quality and disease resistance. Involved in seed, flower and fruit formation.
Calcium	Involved in formation of cell walls and root and leaf development. Participates in translocation of sugars. Improves fruit and nut formation. Involved in uptake of other nutrients. Improves postharvest quality of fruits and vegetables. Aids in the control of certain fungal and bacterial diseases.
Copper	Involved in photosynthetic and respiration systems. Assists chlorophyll synthesis and used as reaction catalyst. Improves nitrogen utilization. Involved in protein formation and root metabolism.
Iron	Involved in respiration and chlorophyll synthesis. Improves plant appearance. Required for vigorous growth.
Magnesium	Involved in photosynthetic and respiration system. Active in uptake of phosphate and translocation of phosphate and starches. Improves seed production and formation of seed oil and fat. Involved in uptake of other nutrients.
Manganese	Involved in regulation of enzymes and growth hormones. Assists in photosynthesis and respiration. Improves germination and hastens maturity. Involved in uptake of carbon, magnesium and phosphorous. Manganese is key on resistance development to both root and foliar diseases caused by fungi.
Molybdenum	Involved in enzymatic reduction of nitrates to ammonia. Assists in conversion of inorganic phosphate to organic form. Improves nodule formation and fixation of nitrogen. Assists protein formation. Required for the synthesis and activity of the enzyme nitrate reductase (reduces nitrates to ammonium in the plant.)
Sulfur	Involved in formation of nodules and chlorophyll synthesis, structural component of amino acids and enzymes. Improves cold resistance and disease resistance. Assists decomposition of crop residue. Involved in protein formation and uptake of other nutrients.
Zinc	Involved in production of growth hormones and chlorophyll. Active in respiration and carbohydrate synthesis. Improves plant appearance, seed production and absorption of water. Involved in protein and carbohydrate formation.

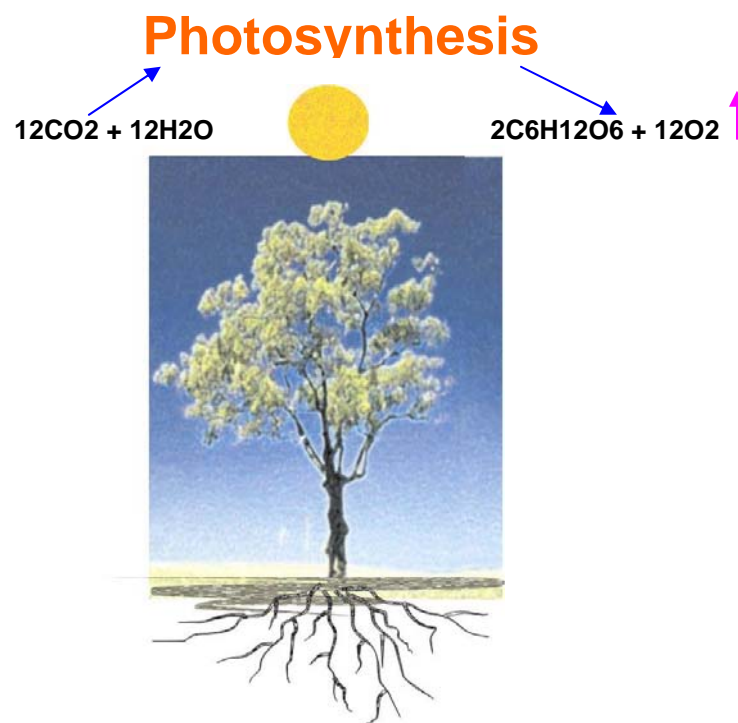
The importance of fertilizers is like food to human bodies. Besides targeting to maintain the vigor health of plants, the adequate balance in the soil nutrients is too, the main concern.

What makes HighGrow different from other fertilizers?

The unique beneficial elements in HighGrow evolves around three acids : Amino Acids, Fulvic Acids and Citric Acid.

Amino Acid

- opens the stomata guard cells
- increase intake of CO₂ by 40-50%
- to balance the process of photosynthesis, more water is needed
- roots will therefore spread wider, deeper to absorb more water
- indirectly this will encourage nutrients uptake from the soil



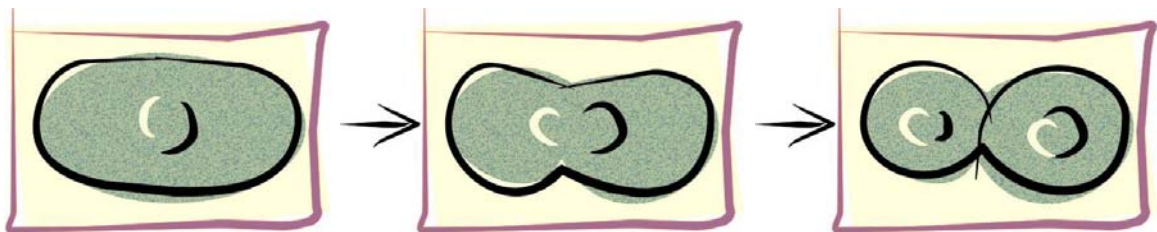
Amino Acid also helps to :

- ✚ Increase permeability of plant cells.
- ✚ Minerals are attached to amino acid through the process of chelation; there is greater penetration of the cuticular membrane at high velocity by simple diffusion. Amino acid has permeability properties.
- ✚ Smuggling of essential nutrients to the plant cells as part of amino acid
- ✚ As some of the nutrients in the soil are positively charged cations, they are easily leached off due to not being able to attach to the negatively charged soil. Amino acid binds these nutrients and 'smuggle' them into the plants, especially calcium, which has very low biological activities.

- ✚ Easy absorption of amino acid
- ✚ Amino acid is biologically active upon entering the cell. This appears as a more rapid response by the plant to the nutrients.
- ✚ Increase resistance of the plants
- ✚ Amino acid increases the resistance level of the plants to conditions of stress such as extreme and/or fluctuations of temperatures, drought and diseases.
- ✚ Protein Saving
- ✚ Amino acid provides and stores protein in the plants. Being self-sustained of protein is important, especially when the plants are under adverse soil or weather conditions.

Citric Acid

When amino acid increases the intake of carbon dioxide, abundance of food will be generated. Citric acid will accelerate cells divisions to cater for the storage of this excess food. This process is carried out without changing the RNA or DNA of the plant.

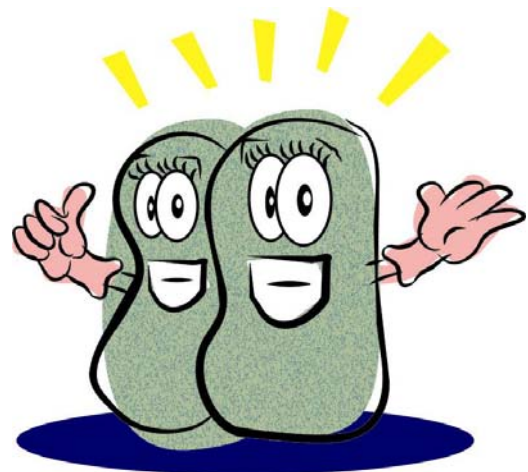


e.g.
 Normal cell division takes 7-8 mins
 With citric acid cell division takes 4-5 mins

Citric Acid also helps to :

- ✚ Supplies calcium and magnesium.
- ✚ Increases soil pH and the availability of phosphorus, molybdenum, and magnesium.
- ✚ Reduces harmful concentrations of aluminum, manganese, and iron.
- ✚ Increases favorable microbial activity, which results in an increased release of nitrogen, phosphorus, boron, sulfur, and other elements from the soil organic matter.
- ✚ Results in better soil structure and tilth.
- ✚ Increases both the solubility of uranium in soil and its bioavailability for plant uptake and translocation.
- ✚ Increase the rate of cell division, and thus promoting plant growth.

- ✚ **Cleaning up the soil of toxic, and bringing the soil to neutral level. Toxic in the soil will harm the microorganisms in the soil thus affecting the absorption of micro and macronutrients of the plants. With insufficient nutrients being absorbed, the growth of the plant is being affected.**
- ✚ **Stimulates growth of new cells and correcting deficiency problems.**
- ✚ **Traps light energy and aid in the process of photosynthesis.**
- ✚ **Citric acid helps to break down food sugars and enhance nutrients absorptions.**
- ✚ **Citric acid is essential for good health when combined with other nutrients**
- ✚ **Act as food reservoir to stimulate plant growth and metabolism of beneficial soil micro organism**
- ✚ **Provides penetrating power and act as a carrier for other components.**
- ✚ **Nutrients source for creating and renewing life**
- ✚ **Catalysts and controls the natural reactions of metabolism.**
- ✚ **Nitrogen Fixation – the abundance of nitrogen in the atmosphere is in a form where the plants cannot absorb. Citric acid will 'fix' the nitrogen molecules to which it is easily absorbed by the plants.**
- ✚ **Changes atmosphere rich in Carbon Dioxide into oxygenated mixture**
- ✚ **Produces more chlorophyll and proteins, which promotes vigorous growth of axillary buds, formations and pollinations of flowers, thus increasing fruit weight and early maturation.**
- ✚ **Helps to enhance resistance to drought and cold.**
- ✚ **Assist plants in transforming food to energy.**
- ✚ **Nourishes plants**



Fulvic Acid

- ❖ Fulvic acids are soluble in alkaline, acid and neutral environments. This is an important quality, since plants absorb nutrients in solution. Furthermore, their low molecular weight facilitates penetration into plants.
- ❖ Fulvic acids improves the structure of soil, retaining moisture, encouraging aeration of the root and providing the plant with nutrients including nitrogen, phosphorous, potassium, magnesium, sulfur and Micronutrients. It contributes to the conversion of minerals from non-assimilable to soluble form through the release of carbonic gas.
- ❖ Fulvic acids have a positive effect on the growth and development of crops due to an increased extraction of macro- and Micronutrients and, on a biochemical level, they increase permeability of membranes. All of the above leads to the following benefits:
 - ✚ An improvement in soil structure
 - ✚ An increase in fertility
 - ✚ A biostimulant effect.
 - ✚ An increase in photosynthesis and ventilation. In other words the speed of catching light is increased, which encourages a larger production of sugars.
 - ✚ An improvement in the transport of nutrients, making them available in the areas where the plant needs them.
 - ✚ An increase in the synthesis of proteins and nucleic acids, which will facilitate the action of enzymes formed with some amino acids and Micronutrients.
 - ✚ An increase in absorption.
 - ✚ Contributes to an increased exploitation of water by the plant.
 - ✚ An increase in fertility, as soil that has a low level of organic material can increase microbial life by up to 2000 times in just two weeks.
 - ✚ An improvement in soil structure through the flocculation of clay in order to form blocks that facilitate the circulation of water and air around the root.
 - ✚ An increase in the movement of ions allowing them to be absorbed by the plant.
 - ✚ Shock-absorbing effect of the pH through the slow release of stored nitrogen. This is extremely important since an excess of acidity will make ions insoluble, as is the case with boron and an opposing variation of the pH, in other words an alkaline pH will burn the plant.
 - ✚ Soil toxins are neutralized if a pesticide has contaminated the soil, leaving it in acceptable conditions for the plant.
 - ✚ Applied in small amounts, they produce a significant increase in the production of dry material, which will lead to a stronger plant.
 - ✚ An improvement to radical elongation, the arrangement of lateral and adventitious roots, radicular and absorbent hairs. In other words, it stimulates radicular growth allowing the plant to better absorb water as well as nutrients.
 - ✚ Fulvic acids are also an excellent food for mycorrhizal fungus, which have an increased radicular development as well as providing excellent protection for pathogenic fungi.